

FCC §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for Occupational/Controlled Exposure

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Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (Minutes)
0.3-1.34	614	1.63	*(100)	6
1.34-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5.0	6

f = frequency in MHz

* = Plane-wave equivalent power density

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,j}} \leq 1$$

Worst case as below:

Frequency (MHz)	Antenna Gain		Tune up Conducted Power		Tune up Average power	Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)	(mW)			
824-849	1.0	1.26	32.5	1778.28	222.29	50	0.009	2.75
1850-1910	3.5	2.24	31.0	1258.93	157.37	50	0.011	5.0
136-174	3.2	2.09	43.1	20417.38	10208.69	50	0.679	1.0

Note:

For GSM mode, the Time-base average power was consideration, Average power as below:

GSM850: $1778.28 \times (1/8) \text{mW} = 222.29 \text{mW}$.

PCS1900: $1258.93 \times (1/8) \text{mW} = 157.37 \text{mW}$.

For DMR mode, the duty cycle of 50% was consideration, Average power as below:

$20417.38 \times 50\% \text{mW} = 10208.69 \text{mW}$.

Simultaneous transmitting consideration: GSM850 and DMR, or PCS1900 and DMR

The ratio = $\text{MPE}/\text{limit}_{824\text{MHz}} + \text{MPE}/\text{limit}_{\text{DMR}} = 0.009/2.75 + 0.679/1.0 = 0.682 < 1.0$.

The ratio = $\text{MPE}/\text{limit}_{1850\text{MHz}} + \text{MPE}/\text{limit}_{\text{DMR}} = 0.011/5.0 + 0.679/1.0 = 0.681 < 1.0$.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 50 cm from nearby persons.

Result: Compliance